



ICRISAT HYBRIDS AND VARIETIES IN 1987

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Introduction

This paper concerns released and promising hybrids and varieties from ICRISAT. In the case of released hybrids and varieties attention is focused on certified seed production and, for WC-C75, a survey on farmer acceptance is reported.

Data from the AICMIP trials have been analyzed further to examine if the material has any particular adaptations within India. As in the ICRISAT reports on the International Pearl Millet Adaptation Trials (IPMAT), data are reported for India on a north/south basis. North is defined as all states north of Maharashtra, and south as all states south of and including Maharashtra.

New hybrids and varieties that will be entered in the 1987 AICMIP trials are briefly discussed.

ICRISAT Hybrids

Seed Production of Released Hybrids ICMH 451 and ICMH 501

Two hybrids were released in 1986: ICMH 451 with B1A as the seed parent, and ICMH 501 with 834A as the seed parent. Data for the supply of breeder seed and information on planting areas, show that only ICMH 451 is being multiplied on a large scale. In Nizamebad district of Andhra Pradesh alone, there are over 1000 ha of seed production plots of ICMH 451. Various estimates indicate that seed sufficient to plant perhaps 1 million ha or more will be produced for the 1987 kharif season. Seed production of ICMH 451 has proved to be straightforward, because the synchrony of the parental lines is good, with the pollinator flowering 1-3 days earlier than the seed parent. This means that pollen is available when B1A first

flowers, and agronomic manipulation can improve the synchrony still further if this is required. The yields from B1A have been good, as under favourable environments, it is high-tillering with very good seed set.

By contrast, there are difficulties in producing seed of ICMH 501. At certain planting dates seed set can be very poor on the male-sterile line B34A (Table 1), and seed set is never excellent. There is also a lack of synchrony, with the pollinator flowering about 17 days later than the seed parent. These difficulties will almost certainly mean that ICMH 501 will not be multiplied on a wide scale, although the hybrid has the advantages of earliness, large seed size, a pedigree unrelated to previously released hybrids, and high downy mildew resistance.

Seed Production of Promising Hybrid ICMH 423

ICRISAT hybrid ICMH 423 has yielded slightly more than MBH 110 in the AICMIP trials. It has B41A as the seed parent and the phenotype of the hybrid is similar to BK 560. Its acceptance with farmers could therefore be high, and the evidence so far is that seed production would be easy. We expect almost perfect synchrony between the two parents. The pollinator ICMH 423 (EC-53-211-1) is profusely tillering, vigorous, and a good pollen producer. The male-sterile line should also be productive and has excellent seed set.

Adaptation of ICMH 451, ICM 501, and ICMH 423

The performance of these three hybrids has been analyzed on a north/south basis (Table 2). The yields of the ICRISAT hybrids are expressed relative to all of the entries in the trial (i.e., the trial mean yield), so if the relative performance of the hybrid changes from north to south it shows that its adaptation differs from the average adaptation of the entries. On this basis ICMH 451 and ICMH 501 are somewhat more adapted to the south

than the average entry, whilst ICMH 423 is more adapted to the north. Among the three hybrids, ICMH 451 shows the greatest stability between regions.

The same analysis has been made relative to MBH 110, and ICMH 451 and ICMH 501 have similar adaptations to it (Table 3), because they have approximately equal superiorities in both north and south. ICMH 423 is markedly superior to MBH 110 in the north (Table 3).

Hybrids ICMH 83401 and ICMH 84122

ICRISAT hybrids which have been in the AICMIP trials for 1 or 2 years all have 81A as the seed parent. Of these ICMH 83401 has shown, over 2 years, almost the same superiority to MBH 110 as ICMH 451. ICMH 84122 in its 1st year in the trial was the highest-yielding 81A hybrid.

New Hybrids

In an attempt to diversify the genetic base of the hybrids, and--it is hoped--to increase yields further, ICRISAT will enter into the 1987 AICMIP trials two hybrids on 852A, and one hybrid on 863A. The two hybrids on 852A, ICMH 85108 and ICMH 85231, have outyielded MBH 110 in ICRISAT trials by about 18%. We will continue to try to put hybrids on new male-sterile lines in the AICMIP trials to test the value of the male-sterile lines, and to try to ensure that there is a choice of hybrids with different seed parents. We are giving emphasis, in our 1987 ICRISAT trials, to hybrids on 863A, ICMA 87001, ICMA 87002, and ICMA 87003.

ICRISAT Varieties

Released Varieties WC-C75, ICMS 7703, and ICMS 7704

Multiplication and cultivation of WC-C75. The Maharashtra State Seeds Corporation obtained 15 kg of breeder seed from ICRISAT in December 1981.

They increased this seed to 550 t within two generations and 10 months. Of this, 508 t were sold for the 1983 season, and about 110 t of seed produced by other government and private seed agencies were also sold. At a seed rate of 2.5 kg ha^{-1} , about 250 000 ha were planted in 1983. Besides the existing foundation and certified seed stocks produced in 1983, estimated at 1200 t, 12 seed-production agencies in India requested and received 261 kg of breeder seed for the 1983-84 off-season increase, which meant that about 100 t of foundation seed were available for increase in 1984.

Although the cultivation of WC-C75 by farmers had spread to all the nine major pearl millet producing states of India by the 1984 rainy season, large-scale farmer use and seed multiplication was largely confined to Maharashtra. However, we estimate that in 1985 over 1 million ha of WC-C75 were planted in India, including 400 000 ha in Maharashtra, and at least 200 000 ha in Haryana, Rajasthan, and Uttar Pradesh. In Tamil Nadu, where WC-C75 was not grown at all 2 years earlier, over 50% of its 385 000 ha of pearl millet was planted to WC-C75.

By the 1986 seed production season, there was large-scale seed production in most of the nine states, including Rajasthan, Gujarat, Uttar Pradesh, and Haryana. The demand for breeder seed of WC-C75 continues. For example, from January 1985 to April 1986, in response to requests for 800 kg of breeder seed, ICRISAT supplied 560 kg to seed production agencies in India. Recent ICAR figures give a planned production of more than 4 870 t of certified seed for the 1987 kharif planting, sufficient to plant 1.5 million ha.

Farmer's perceptions of WC-C75. A survey was conducted to examine how WC-C75 compared with hybrids and the local varieties, since there was little

information on the acceptance and adoption of WC-C75 by farmers. The survey was conducted in Maharashtra in 1986 by economists in the ICRISAT Resource Management Program. Farmers were asked to evaluate WC-C75 relative to the four main competing cultivars—local varieties, and hybrids BK 560, BJ 104, and MBH 110. The competing cultivar was considered to be what the farmer was growing before he tried WC-C75; it varied between district and farmer. Farmers were questioned about several characters of the cultivars including yield, price, maturity, disease resistance, and the use of home-produced seed for resowing WC-C75. In assessing each character farmers were given four options: WC-C75 was (1) superior to, (2) inferior to, (3) about the same as the competing cultivar, or (4) farmers' had insufficient information on which to make a comparative evaluation.

Farmers saw WC-C75 as yielding more than the local varieties, yielding about the same as hybrids BK 560 and BJ 104, and yielding less than hybrid MBH 110 (Table 4). The advantage in grain yield over the local was to some extent eroded by the farmers' view of a lower grain price for WC-C75 compared with the local. However, WC-C75 was more often considered superior in grain price to BJ 104 and BK 560. About 75% of the interviewed farmers also felt that WC-C75 fetched a lower price than MBH 110, reinforcing MBH 110's perceived yield advantage. Farmers cited the smaller and elongated grain shape of WC-C75 and nonuniformity in grain size relative to MBH 110 as factors contributing to its lower price.

An overwhelming majority of farmers perceived that WC-C75 gave higher fodder yields than all three hybrids. Most farmers also thought that WC-C75 produced more fodder than the local cultivars. Perceptions on comparative performance in fodder price were not as sharp, but the data on fodder price (Table 4) suggest that WC-C75 does enjoy an advantage in fodder quality over all the hybrids, and particularly over MBH 110.

With regard to the incidence of downy mildew, ergot, and smut, almost all the interviewed farmers reported that disease incidence had not been high enough, during the last 3 years, to significantly reduce pearl millet yields. Farmers observed, however, that either there was no disease attack on WC-C75, or that WC-C75 was less susceptible to disease. Nonetheless, because of the negligible incidence of the major pearl millet diseases in the districts surveyed, this potential advantage of WC-C75 was not realized.

In summary, the variety WC-C75 has compared well against hybrids. It is superior in several ways to the public-sector hybrids BK 580 and BJ 104, including grain price, where the advantage of WC-C75 is perhaps unexpected. The success of WC-C75 is illustrated by the fact that 80% of the farmers interviewed responded that they would plant WC-C75 next season.

Seed costs and production of WC-C75. The cost of production of certified seed of WC-C75 is less than that of hybrids. However, the lower price of certified WC-C75 seed (Rs.6 kg⁻¹ compared with Rs.12-14 kg⁻¹ for hybrid seed) caused farmers to suspect that either the quality of WC-C75 seed was not good, or that the cultivar itself was not very promising. Most farmers thought WC-C75 was a hybrid, and they did not know that they could plant last year's harvest without suffering a visible reduction in yield in the following year. The few farmers who were aware of the varietal nature of WC-C75 preferred to purchase seed from the market. They thought that their home-produced seed was not of good quality and believed purchased seed to be superior. Thus, the assumption by plant breeders that farmers would regard it as an advantage to be able to replant their own seed of an open-pollinated variety without significant yield loss was shown to be unwarranted. Nevertheless, the easier seed production of WC-C75 was an

advantage when the hybrid BJ 104 became susceptible to downy mildew; WC-C75 could be multiplied very rapidly, and it soon replaced BJ 104 over large areas.

Although the inferiority of WC-C75 to MBH 110 in grain yield and quality is marked, the area devoted to WC-C75 is still high, almost certainly because seed production difficulties in MBH 110 have limited its supply. For a good hybrid to compete well with an open-pollinated variety it requires not only a superior agronomic performance, but also freedom from major seed production problems.

Multiplication of ICMS 7703 and ICMS 7704

ICRISAT has two other released varieties: ICMS 7703 and ICMS 7704. Considerable quantities of breeder seed have been distributed to various seed producing agencies, but the extent of production in Nizamabad (A.P.) seed production plots in 1987 is much less than for WC-C75.

Adaptation of Some ICRISAT Varieties

The performance of the three released varieties and ICTP 8203 on a north/south basis has been assessed in the same manner as that of the hybrids (Table 5). The differences between north and south, except for ICTP 8203, are less marked than the north/south difference in the hybrids. However, the trial mean has a large contribution from ICRISAT entries, so large differences should perhaps not be expected. It would perhaps be better to analyze yield relative to MBH 110, but this hybrid has not been a control in the trials in all the years analyzed. There is a weak indication that ICMS 7704 is more adapted to the south, and ICTP 8203 is clearly more adapted to the south (Table 5). ICTP 8203 yields less than the trial mean in the north, but considerably more than the trial mean in

the south.

Varieties in AICMIP Trials

The grain yield of ICRISAT varieties currently in the AICMIP trials is not markedly better than that of WC-C75 (Table 6). The best entry over more than 1 year, ICMV 81111, has a higher grain yield (104% of WC-C75), but this yield advantage is probably no better than that of ICMS 7704.

The survey data on WC-C75 indicate that greater attention needs to be paid to factors other than grain yield in determining farmers' acceptance. It is therefore of note that ICTP 8203 is early, has bold grains, a marked phenotypic dissimilarity to previously released varieties, and yields as much or more than WC-C75 in the south of India. ICMV 81111 and ICMV 82132 have very high fodder yields, and ICMV 82132 and ICMS 8283 have resistance to smut.

The yields of ICMV-F8400 and ICMS 8235, which have been only 1 year in the trials, indicate that appreciable yield advances over WC-C75 may have been made.

New Varieties

In 1987, ICRISAT will contribute three varieties to the AICMIP trials. These varieties come from the composites NELC, MC, and IVC. In IPMAT 1986 they outyielded WC-C75 by 12-17%. This margin of superiority is the highest recorded in any IPMAT trial. There is certainly hope that ICRISAT varieties, having shown improved yield, smut resistance, and uniformity over WC-C75, will now have a substantial yield advantage.

Table 1. Effect of sowing date on seed set in B34A and B34B, Patancheru, 1988-89.

	Date of sowing									
	4 Jul 85	7 Aug	9 Sep	10 Oct	7 Nov	8 Dec	8 Jan 86	7 Feb		
Date of 50% flowering	22 Aug 85	23 Sep	24 Oct	1 Dec	4 Jan 86	8 Feb	2 Mar	30 Mar		
Seed set (%) B34A	72	47	23	21	20	48	44	32		
Seed set (%) B34B	80	70	64	47	50	62	67	44		
Min. temperature	23	21	14	11	11	17	20	22		
Max. temperature	32	31	29	29	28	30	33	38		

1. Weather data for dates at 50% flowering, ICRISAT Center.

Table 2. Grain yield of three ICRISAT hybrids in the AICMIP trials on a north/south basis relative to trial mean yield.

Entry	Grain yield (% trial mean)							
	1983		1984		1985		Mean across years	
	North	South	North	South	North	South	North	South
ICMH 451	-	-	107	124	116	110	112	117
ICMH 501	-	-	107	131	98	103	103	117
ICMH 423	124	114	114	101	109	99	116	105

Table 3. Grain yield of three ICRISAT hybrids in the AICMIP trials on a north/south basis relative to the yield of MBH 110.

Entry	Grain yield (% MBH 110)							
	1983		1984		1985		Mean across years	
	North	South	North	South	North	South	North	South
ICMH 451	-	-	103	106	116	103	110	105
ICMH 501	-	-	110	112	98	96	104	104
ICMH 423	123	102	106	94	109	92	113	96

Table 4. Farmers' perceptions of WC-C75 in comparison with competing cultivars, in selected districts of Maharashtra, 1988

1. Farmers interviewed																
Character	Lalel (88) ¹				Bj 104 (48)				DK 600 (88)				MSM 110 (48)			
	Super- ior	Infer- ior	Some know	Don't know	Super- ior	Infer- ior	Some know	Don't know	Super- ior	Infer- ior	Some know	Don't know	Super- ior	Infer- ior	Some know	Don't know
Berry yield	88	10	4	0	46	40	14	0	42	48	13	0	18	78	8	0
Fodder yield	54	19	17	0	38	9	5	0	82	11	7	0	88	8	7	0
Grain price	4	44	33	19	40	14	30	16	38	21	28	18	2	74	7	18
Fodder price	14	6	52	28	32	5	44	18	36	10	30	20	58	0	18	28

1. Figures in parentheses are the number of farmers interviewed

Table 5. Yield of four ICRISAT varieties in AICMIP trials on a north/south basis relative to trial mean yield.

Entry	Grain yield (% trial mean)									
	1978		1979		1980		1981		1982	
	North	South	North	South	North	South	North	South	North	South
WC-C75	103	110	94	118	106	86	104	98	100	105
ICMS 7703	-	-	111	109	108	106	104	88	107	106
ICMS 7704	-	-	-	-	111	123	106	105	99	108
ICTP 8203	-	-	-	-	-	-	-	-	-	-

(Contd)

Entry	Grain yield (% trial mean)									
	1983		1984		1985		1986		Mean across years	
	North	South	North	South	North	South	North	South	North	South
WC-C75	102	110	105	97	104	108	-	-	102	104
ICMS 7703	98	106	-	-	-	-	-	-	108	103
ICMS 7704	105	109	105	111	102	98	-	-	105	109
ICTP 8203	-	-	105	130	86	109	78	105	90	115

Table 8. Performance of ICNIBAT varieties and synthetics in AICNIP population trials, 1983-86.

	No. of years	Mean across years (kg ha ⁻¹)	% WC-C75	1986 kg ha ⁻¹	Rank	Fodder ² (% of checks)
Three or four years in trial						
ICMV 81111	3	1760	104.0	1747	4	127
ICMS 8010	3	1713	101.8	1768	2	102
ICMS 8021	4	1642	101.7	1841 ¹	10	114
ICTP 8203	3	1608	95.8	1555 ¹	14	90
WC-C75	4	1615	-	1753	3	-
WC-C75	3	1682	-	1753	3	-
Two years in trial						
ICMV 82132	2	1760	97.8	1730	5	134
ICMS 8283	2	1685	93.4	1885	7	94
ICMV 83118	2	1656	91.8	1575	12	112
WC-C75	2	1804	-	1753	3	-
One year in trial						
ICMV-F8400	1	-	-	2010	1	106.8
ICMS 8235	1	-	-	2008	2	106.8
ICMV 83104	1	-	-	1845	7	98.0
WC-C75	1	-	-	1882	5	-

1. Below All-India mean.

2. Over years before 1986 because no data available for 1986.